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PROPOSALS FOR NEW OR EXPANDED RESEARCH ON
COTTON AND COTTONSEED
FOR
COTTON AND COTTONSEED TECHNICAL SUBCOMMITTEE AT FEBRUARY 1956
MEETING

I. PRODUCTION RESEARCH

(Order of listing has no priority significance)

- A. Irrigation and Soil Management Practices for Cotton in the Southwestern United States. -- Expand research on ways and means of improving soils, soil management systems and utilizing water more efficiently in cotton production under irrigated conditions in the Southwestern United States.

This research would include for the major cotton producing areas studies on the water requirement and consumptive use of water, optimum water and moisture level and timing of irrigation to physiological stage of growth of the cotton plant, best irrigation methods, drainage and salinity relations, crop rotations and cultural practices, tillage methods, nutrient balance in relation to commercial fertilizer use, and the incorporation of the best combination of soil and water practices into a farming system for maximum sustained production of cotton of highest quality. (New)

- B. Weed Control -- Expand research on both mechanical and chemical weed control including mechanization studies pertaining to equipment to keep pace with the continued trend toward more complete mechanization of cotton production.

Of particular importance is the need to develop more effective chemicals for control of weeds after crop stands are insured. Additional research is needed for obtaining satisfactory control of lay-by grasses which tend to cut farmers profits when cotton is harvested mechanically in such fields. Further basic information is needed on the manner in which the herbicidal activity of specific chemicals is affected by varying soil types and different environmental conditions, especially with regard to possible harmful accumulations. In certain areas, one of the principal needs is for the development of a cheaper chemical means for eradicating perennial weeds and grasses that have become established on cotton farms. Mechanization studies should be expanded to develop more suitable equipment for both mechanical and chemical weed control. (1955 3/22)

- C. Mechanical Harvesting of Extra-Long Staple Cotton -- Initiate engineering research to develop a satisfactory mechanical picker for extra-long staple cotton.

1/Revised listing in priority order to be furnished CCRMAC after CCTS meet.
(*) Asterisks (*) will be used throughout to indicate those proposals of possible interest to more than one Panel.

Existing machines for harvesting short and medium staple cotton should be studied with the idea of modifying them for adaptation to harvesting long staple varieties. Losses from both field picking efficiency and grade are too high with the present type of mechanical pickers. Work is also needed on the mechanization phases of all production practices pertaining to extra-long staple cotton. (1955 8/22)

- D. Pink Bollworm Control -- Expand and maintain research on the pink bollworm to: (1) develop more effective and economical methods of meeting quarantine regulations, (2) prevent further spread, and (3) develop effective and economical methods that can be employed by growers to control the pest.

Although six States, Industry and the Government have cooperated during the past few years in financing an expanded coordinated research program on this insect, the goal set as a peak for pink bollworm research has not yet been reached. Additional funds should be made available to reach and maintain the desired level of research support until satisfactory progress has been attained in alleviating the threat imposed by the pink bollworm on the economical production of cotton in this country. The biennium appropriations of two states expire 6/30/56. The commitment of industry for furnishing funds and the biennium appropriation of another state will expire 6/30/57. It is questionable that any of these appropriations will be renewed.

As a result of research during the past few years, oil millers and ginners in the pink bollworm quarantined areas are now saving \$1,250,000 annually that was formerly required to meet quarantine regulations. This saving alone more than pays for research expended each year on all aspects of the pink bollworm research program. A new experimental insecticide is under investigation that is four times as effective as DDT, the present standard, in reducing field infestations. Progress is being made on other phases of the work, especially along the line of destroying pink bollworms at the gin and in the field. Further reduction in costs of meeting quarantine requirements, in reducing and holding down below the damage point field infestations, and in preventing the spread to new areas of the pink bollworm appears likely if support can be continued. (1955 1/22)

- E. Systemic Insecticides -- Expand research to develop systemic insecticides which may be safely and economically used to control injurious cotton insects.

Some of the systemic insecticides tested as seed treatments have shown outstanding promise in control of early-season insects such as thrips, aphids, spider mites, cotton fleahoppers and overwintered boll weevils. The seed or soil treatment method which translocates the insecticide through the sap stream to portions

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of the plant on which the insects feed, would have many advantages over the conventional spray and dust methods now being used. Very few, if any, beneficial insects that live primarily on other insects would be killed. Unfavorable weather and wet fields, which often prevent foliage applications being made at the right time, would not interfere with the continued effectiveness of the systemic insecticide. Costs of labor and machinery for making the application would be eliminated or reduced to a minimum.

The control of early-season pests would permit early fruiting and the control of hibernating boll weevils would likely delay build up of the weevil in many years to the extent that the crop would be made before significant damage resulted. If insecticide treatments are not required for controlling the boll weevil, the bollworm will less likely increase to damaging numbers.

Much research will have to be done before seed or soil treatments with systemics can be practical and recommended. Possibility of reducing seed germination and of injury to cotton seedlings will have to be overcome or eliminated. Determinations must be made as to whether the fiber is affected and whether undesirable residues are left in the seed. (1955 10/22)

- F. Insect Resistance to Insecticides -- Initiate research designed to provide basic information on the resistance of cotton pests to insecticides.

It is known that several cotton pests, such as spider mites, the salt-marsh caterpillar, and the cabbage looper, have developed a resistance to certain insecticides which were formerly highly effective against them. In 1955 there have been widespread reports of failures of insecticides to control the boll weevil, thrips, and Lygus bugs. More insecticides are used for the control of these pests on cotton than all other cotton pests combined, and if a high degree of resistance to recommended insecticides has developed, it could mean high degree of resistance to recommended insecticides has developed, it could mean economic disaster to cotton farmers over a wide area in the absence of satisfactory substitutes. These studies should be designed to determine (1) the extent to which boll weevil, bollworm, cotton leafworm, cotton aphid, salt-marsh caterpillar, Lygus bugs, spider mites and other pests have already developed resistance to the currently recommended insecticides; (2) the possibility of future generations acquiring resistance under continuous exposure to insecticides; and (3) whether resistance to one insecticide or a group of insecticides will carry over to other organic insecticides. (1955 16/22)

- G. Humid Region Drainage Research -- Expand drainage research in the humid region to provide sound information for design and operation of surface and subsurface drainage systems for maximum economic cotton crop production.

Expansion along the following lines is urgently needed:

- (a) More adequate determinations of the drainage requirements of different crops.
- (b) Comparisons of surface drainage, subsurface drainage and combinations of the two in several of the major drainage problem areas.
- (c) Comparison of methods and machines for land forming, with particular emphasis on costs of the operation and on resulting soil productivity and on efficiency of subsequent farm operators.
- (d) Study of relationship of soil characteristics to design of drainage systems.
- (e) Study of improved techniques for locating and installing interceptor drains for "seep spot" conditions. (New)

- H. Humid Region Irrigation Research -- Expand humid region irrigation research to provide information for deciding where, when, and how to irrigate cotton in the humid region for most profitable production.

Expansion should be along the following lines:

- (a) Relationship between soil moisture conditions and cotton production with emphasis on critical periods of plant growth in relation to quality in order to give maximum economy of water and of equipment and labor use.
- (b) Study of drought frequency in relation to rate of water use by cotton. Such a study is now in progress in limited area and needs to be greatly expanded. Included will be measurements of actual water use under varying climatic and soil moisture conditions.
- (c) Study of methods and equipment for application of irrigation water in the humid region. Included will be the comparison of surface with overhead application and evaluation of power units and pumps under different operating conditions.
- (d) Economics of water use in humid area to provide information for determining conditions under which irrigation will pay.

- (e) Study of water laws and legal and organizational aspects of water management in the humid region to provide a basis for effective water development and use of both ground and surface resources.
- (f) Initiate studies on the effects of irrigation on other management practices for cotton production, such as insect control practices, fertilization, adaptation of varieties, deterioration of bolls, and resultant alteration of seed and fiber qualities. (1955 7/22)

I. Moisture Conservation on Crop Land -- Expand research on moisture conservation on crop land in low rainfall areas.

While this problem has been recognized for some time in the dry farming areas of the plains, recurring drouths in the Eastern States point to the necessity for moisture conservation research in the humid area. The amount of water lost by evaporation following various tillage operations from different kinds of soil and with a range of soil moisture and weather conditions needs to be determined. The water economy of winter cover crops is not well defined, and measurements of the water transpired by the growing cover crop in relation to the water saved through decreased runoff are needed. The use of herbicides to kill or retard perennial sod crops well in advance of seedbed preparation for the following row crop may offer opportunities for increased storage of soil moisture. Improved management practices for drouth tolerant crops such as grain sorghum are needed. The current research program on the development and evaluation of mulch tillage intercropping, loose seedbeds, ridge-row tillage, and other new tillage systems should be expanded and more information on soil moisture balance under various tillage systems obtained. (New)

- J. Nematode Control -- Expand research on nematodes as a limiting factor in cotton production, with emphasis on improvement of preventive measures and chemical control methods. (New)
- K. Soil-Borne Disease Control -- Initiate research on the effects of cultural methods, soil management, crop sequences, use of crop residues, manures, and green manures, and other production practices upon the micropopulation of the soil and the inter-relations of these factors with the buildup or suppression of soil-borne diseases of crop plants. (New)
- L. Ginning of Extra Long Staple Cotton -- Initiate work to modernize the ginning of extra long staple cotton by adapting saw ginning principles or developing new principles.

Extra long staple cotton can be machine picked with some sacrifice in grade which will be minimized with improvements in spindle

pickers. These varieties can be handled pneumatically at the gin before and after roller ginning, artificially dried and cleaned with the same or similar equipment as used on upland varieties with no harmful effects. However, roller ginning, the actual separation of the lint and seed, is extremely slow. Saw ginning is four to five times faster than roller ginning but reduces the staple length and increases nep content many fold. Therefore adaptation of saw ginning principles or the development of new principles for speeding up this operation with no harmful effects on the fiber is essential for modernizing the ginning of extra long staple cotton. (1955 9/22)

- M. Gin Control Improvement -- Expand research to maintain fiber and seed quality during ginning by the development of automatic controls for driers and other pieces of equipment which when improperly used may cause fiber degradation.

New machinery and the speeding up and streamlining of operations at gins necessitates the use of automatic controls not only for efficient operations but for maintaining quality of the product. Ginners at modern gins can no longer physically inspect the cotton, manually manipulate controls and do a good job in preserving the inherent quality of the cotton. The development of equipment for automatically controlling the rate of feeding seed cotton to overhead drying and cleaning equipment has been beneficial. It does not, however, prevent drying to the extent that staple length is reduced during ginning. A sensing element for indicating the moisture content of cotton at strategic points in the system during ginning or an instrument which would indicate the temperature of the cotton from which significant fiber temperature moisture content relations might be developed are needed. If such devices can be adapted or developed they could be used in actuating controls.

Studies are now in progress in adapting devices for indicating moisture and temperature conditions of cotton during ginning but the work should be expanded in view of potentials in reducing the carry-over into trade channels of degraded fiber. (1955 6/22)

- N. Nep Control Improvement -- Expand work to reduce neps in ginned lint by determining what machines and operations are the major offenders, and by developing improvements needed to reduce nep formation.

Results of card web nep counts show that a considerable number of neps are produced in fiber during ginning. The work is at somewhat of a standstill until satisfactory ways and means can be worked out for determining what machines and operations are the major offenders. Card web nep counts do not accurately reflect neps produced by ginning operations because other mechanical operations are involved. Instruments for preparing samples of ginned lint for nep counts have been acquired and some work done

in perfecting the devices and in developing techniques for standardizing operations in obtaining comparable results at the several cotton ginning laboratories. Following the completion of this first phase of the work which will provide a basis for determining where neps are formed in the ginning system, testing and ginning machinery alterations will be required in reducing the number of neps produced. (1955 21/22)

- *O. Effects of Water, Oil and Wetting Agents on Ginning and On Fiber Quality -- Expand research to determine possible harmful effects to ginning and fiber quality from the use of water, wetting agents, and oils applied on mechanical cotton picker spindles.

Various liquids are applied to mechanical cotton picker spindles to prevent the build-up thereon of plant gums and to increase picker efficiency. Spinners suspect that these additives adversely affect ginning, spinning, dyeing and bleaching qualities of the fiber. As the first step in providing an answer to the allegation studies are being made to determine the effects of (1) water, (2) water and wetting agents, and (3) water and oil on ginning quality. The cotton for gin tests is from carefully controlled experiments in which the liquids are applied at different rates. The information thus obtained will be used in determining the possible harmful effects of additives in picking and ginning and provide samples for subsequent spinning, dyeing and bleaching studies. The work has recently been started and should be intensified. (New)

- P. Dust Nuisance at Gins -- Expand research work to prevent dust nuisance at cotton gins by improving trash collecting apparatus and systems.

With urban growth many ginners find themselves surrounded by homes with occupants who complain as to gin dust nuisance. Frequently the ginner must move or install expensive trash collecting equipment which allows little dust to escape. Information generally is not readily available to the ginner as to engineering requirements, and too frequently the installation of dust collectors, fans and other such equipment is made on a cut and try basis with unsatisfactory results. Testing and adaptation of trash collecting equipment should be expanded to provide basic engineering data on which to base recommendations for reducing the dust nuisance around gins. (New)

- Q. Interrelations of Fiber Strength and Elongation -- Initiate fiber quality studies for the purpose of developing cottons with combinations of high strength and high elongation.

In breeding for strong cottons a high correlation has been found between increased strength and decreased yield. Regardless of the source of the strength, it has not been possible as yet to

develop types that possess outstanding strength and have yields that compete with commercial varieties. Progress is still being made in improving the yield and maintaining the strength. There have been criticisms of these high strength cottons on the ground that increased strength is associated with decreased fiber elongation, decreased flex and abrasion resistance. So long as selections have been made on the basis of measurements on the Pressley Braaker at zero gauge length, there has continued to be an association between high strength and low elongation. Using the Stelometer as an instrument for measuring strength (at 1/8 inch gauge length) and elongation, it is believed that it may be possible to select cottons with both increased strength and increased elongation (by eliminating the weak places along the length of one fiber). It should also be possible to find cottons with strengths comparable to that of our present varieties, but with fiber elongations far in excess of present commercial types. There is a need for intensifying our studies on this combination of characters. This approach may give us cottons with increased strength but without decreased yields. (1955 4/22)

- R. Bacterial Blight Control -- Expand research on the control of bacterial blight. A complete reorientation of the breeding program for blight resistance has been made necessary by the recent discovery of a "super" strain of the bacterial blight organism.

Lines of cotton already developed with resistance to the normal strain of blight organism are susceptible to the "super" strain. To avoid indiscriminate or inadvertant spread of the "super" strain into new areas it is imperative that information be obtained as rapidly as possible on the nature of the new strain and on the breeding behavior of resistant lines. One line of cotton has already been found with resistance to the "super" strain but the breeding program must be expanded to include resistance to both the normal and "super" strains of blight. (1955 22/22)

- S. Verticillium Wilt Control -- Expand studies directed toward controlling Verticillium wilt, one of cotton's most damaging diseases over a considerable area of the Cotton Belt.

Expanding losses in yield and fiber quality from Verticillium wilt clearly indicate that the current program of research on controlling this disease is inadequate. Losses of more than a bale to the acre over large areas of New Mexico, Arizona, and California cost the farmers millions of dollars annually. Severe losses also occur in Arkansas, Tennessee, Mississippi, and Louisiana. Increased emphasis should be placed on areas of work such as (1) the search for Verticillium resistance; (2) the acceleration of the program of breeding to incorporate disease resistance into commercially desirable varieties or varieties with specific end uses; and (3) the acceleration of the study of

basic factors underlying the host parasite relationship and the nature of resistance. (1955 13/22)

- T. Cotton Fiber Deterioration -- Expand research to determine the nature and cause of cotton fiber deterioration under field and storage conditions, frequently referred to in the trade as "Cavitoma"; increased research also is urgently needed to develop adequate control measures.

The current program of research on fiber deterioration is being moved forward as rapidly as available funds will permit, but there is critical need for additional support. Work on pre-harvest and cavitomic deterioration of cotton fiber should be expanded in order to (1) accelerate the accumulation of relevant and new basic information, (2) further explore preliminary findings now in hand on the nature of the problem, and (3) investigate all applicable cultural-practice and other methods of controlling and alleviating fiber deterioration. (1955 18/22)

- U. Genetics and Breeding Program -- Expand genetics and breeding program for improving breeding methodology and basic genetic studies, including exploring possibilities of breeding for insect resistance.

Additional work is needed to study the best techniques for developing cotton varieties. It is necessary to know more about the effects of hybrid vigor and the possibility of using hybrid vigor in the breeding program. Improvements in methodology will benefit both private and institutional breeders.

In recent years techniques have been devised for obtaining fertile hybrids from crosses involving wild and cultivated species differing in chromosome number -- crosses previously considered impossible to make. Progress is being made in thus transferring certain new characters to cultivated varieties. This work needs expanding with emphasis on basic genetic studies that may aid the cotton breeder to make more rapid progress in improving fiber quality, disease and insect resistance, drought resistance, cold tolerance, earliness and other desirable agronomic characteristics.

Research also should be undertaken in cooperation with plant breeders to discover characteristics in commercial cottons, cotton species, and cotton relatives that provide insect resistance and examine the feasibility of transferring these characteristics to commercial cottons. It has been shown that various strains, varieties or species of cotton have certain characteristics which tend to make them resistant to insect attack. The success of the British in breeding for Jassid resistance is well known. Studies made several years ago by entomologists at Stoneville, Miss., showed that thickness and toughness of the boll wall determined to some extent the degree of injury caused by boll weevils to cotton bolls. The "Smooth

leaf" characteristic now being established in cotton by breeders is the result of research on cotton aphid resistance in cotton. Workers in Georgia found varietal differences in susceptibility to thrips. The limited exploratory work which has been done in studying insect resistance in cotton has been sufficiently encouraging to indicate that substantial progress might be expected if a full scale research program were initiated in which entomologists joined with plant breeders in a program involving not only the known commercial cotton but also the various wild cotton species and cotton relatives. (1955 11/22 and 20/22)

II. UTILIZATION RESEARCH

[Order of Priority Generally as Determined
by Utilization Panel -- For Overall Rating
See Utilization Panel Report.]

Fiber and Fiber Products

A. Basic Cotton Fiber Research

1. Determine the Inter-relationships Between Cotton Fiber Morphology, Fine Structure and Dyeing and Finishing Behavior of Cotton Textiles -- Initiate research to determine the effect of fiber maturity, shape, coarseness, and other morphological properties, as well as fibril orientation and other fine structure characteristics on the response in dyeing and finishing of fabrics made from those fibers.

It is known that fiber coarseness, maturity, and luster influence the dyeing and finishing performance of cotton. Much is not clearly understood, however, about the effects of these properties on such treatments as the new wrinkle resistant and wash-wear processes. Even less is known about how crystallite orientation, extensibility, surface properties, and non-cellulose constituents affect both standard and specialized finishing processes. Research in this field is important to enable different varieties now grown to perform satisfactorily in dyeing and finishing operations, and to aid cotton breeders in the development of new varieties and types. (CCAC No. 7, 1955) (CRPG 146B)(UP 1/50)

The following approaches are suggested below in the priority order recommended by the Utilization Panel:

- (a) Determination of Cotton Fiber Tensile Mechanics by Microscopy and Electron-Microscopy -- Initiate research to determine the functions of fibrils and other fine structure elements of cotton in relation to the physical properties of native and chemically treated cotton.

Basic information on the fine structure of the cotton fiber would be of great value in studies on the modification of the fiber's properties. This information could be obtained by the use of the light and electron microscope to (1) study the function of the fibrils during extension, (2) compare the fibril structure of different varieties, and (3) investigate the change in fibrillar structure caused by mercerization, decrystallization, and other treatments. (CCAC No. 37, 1955) (CRPG 35B) (UP 8/50)

- (b) Cellulose Crystallite Size and Size Distribution in Cotton -- Initiate studies to determine the crystallite size and size distribution in native and chemically modified cotton and to correlate the results with the physical properties and the chemical reactivity as a basis for improving its utility.

The present proposal contemplates a fundamental study of the microscopic dimensions of the cellulose crystallites in cotton fibers and determination as to whether the dimensions are uniform or represent a spectrum of crystallite sizes, depending upon such variables as variety of cotton, origin, and chemical treatments. This study is necessary in order to better understand the relationship of the crystalline regions of the fiber to their moisture absorption, dyeing phenomenon, tensile and elastic behavior and other related properties of cotton textiles. Dr. Milton Harris of Harris Research Laboratories, expressed the opinion that this field of research is of prime importance. He stated that the research scientists in the rayon industry believe that many of the desirable properties of rayon (which are also desirable in cotton) come from an optimum gradation of the crystallite sizes. (CCAC No. 27, 1955) (CRPG 116B) (UP 29/50)

- (c) Adsorption Techniques for the Evaluation of the Fine Structure and Chemical Reactivity of Cotton -- Initiate research on the application of adsorption techniques to the evaluation of the fine structure and chemical reactivity of cotton in order to develop a rapid and practical method of rating cottons of different characteristics.

Only a portion of the cellulose molecules are accessible to reagents producing chemical modification because of the submicroscopic structure. Fineness of this structure is one of the elements of "character" of cotton. The adsorption of chromophores of different molecular sizes, by cottons which have been subjected to suitable swelling pretreatments, should offer a means of defining the fine structure and chemical reactivity of different cottons even though they may have the same weight fineness and maturity and thus serve as a basis for a rapid and practical method of rating cottons of different characteristics with respect to the fitness for different chemical modifications. (New) (CRPG 199B) (UP 36/50)

- (d) Crystalline-Amorphous Cellulose Ratio by the Nuclear Magnetic Resonance Technique -- Conduct research to determine the usefulness of nuclear magnetic resonance as a principle on which to base a sensitive and rapid method for evaluation of crystalline and amorphous cellulose.

One of the most urgent and continuing needs in modern fiber technology is a means for quickly and accurately determining the proportion of crystalline and amorphous polymer in a textile fiber. None of the methods thus far developed are entirely satisfactory. Modern science indicates that the important physical properties of fibers are highly dependent on the disposition and structural organization of the polymer molecules. In the chemical modification of cotton cellulose, it is very important to know what effect the treatments have upon the nature and distribution of the crystalline and amorphous components. The technique of nuclear magnetic resonance deals with the freedom of atomic nuclei in the molecular chains to respond to high frequency magnetic impulses. This, in turn, depends upon whether these nuclei in sections of the chains are held rigidly in crystalline structure or occur loosely in amorphous regions of the fiber. The latter are much more responsive to changes in the electro-magnetic field. Exploratory experiments with nuclear magnetic resonance have been very promising. (New)(CRPG 117E)(UP 47/50)

2. Determine Comparative Fine Structure of Cotton and Competitive Cellulosic Fibers in Relation to Commercially Useful Properties -- Initiate microscopic studies to provide fundamental information on the relationships of the fibrillar structure of cotton and competitive cellulosic fibers to their commercially useful properties, as a basis for designing improved chemical modification toward increased utilization.

Cotton is currently meeting its strongest competition from other fibers in industrial applications. Improvements in abrasion-, heat- and rot-resistance are imperative to combat the inroads of newer types of fibers in this market. The planning of research to modify cotton to meet competition provided by other natural and synthetic cellulosic fibers is impeded by lack of fundamental knowledge of the sub-microscopic structure, an important factor in chemical reactivity and modification. Approximately 80 percent of the 9 million bales of cotton consumed annually in apparel, household and industrial uses in this country, may be considered to be in the fields where improvements of properties by chemical modification would enhance its value. (CCAC No. 14, 1955) (CRPG 121B) (UP 15/50)

3. Determine Cause of Yellowing in Cotton -- Initiate research to determine the cause of yellowing in cotton fabrics during use and in storage.

The gradual yellowing of white cotton fabrics by age is a common occurrence. Yellowing also accompanies natural soiling, particularly in those fabrics soiled by contact with the skin as in shirt collars and cuffs, sheets and pillow cases.

Such discoloration is a serious matter in bleached fabrics, which account for a large proportion of cotton's markets. Bleaching with peroxide and hypochlorite or masking by bluing or fluorescent dyes is presently the only means of overcoming the objectionable color change. A means of increasing the whiteness retention of cotton fabrics would eliminate the need for frequent bleaching, prolong the useful life of the material, and improve cotton's competitive position relative to the synthetic fibers. (New) (CRPG 140B) (UP 22/50)

4. Determine Mechanism of Mildewing of Cotton - Initiate exploratory research to determine the extent to which electron microscopy and associated techniques may be useful in detecting microbiological degradation of cotton.

Basic information on the way in which microorganisms attack the cotton fiber is of value in the development of methods of protection. Although much has been learned about microbial attack by use of the light microscope, there are certain questions which can only be answered by the higher resolving power of the electron microscope. Existing methods of electron microscopy will need considerable modification in dealing with this new field, and therefore a period of experimentation and the devising of new techniques will be necessary. (New) (CRPG 156B) (UP 43/50)

5. Determine the Inter-relationships Between the Physical and Chemical Properties of Cotton in the Raw, Fiber, Yarn, and Fabric State.-- Initiate research to determine the relations between the physical and chemical properties of raw cotton and those of cotton fiber, yarn, and fabric as influenced, in succession, by mechanical processing and finishing operations, and by application of simulated end-use conditions to the yarns and fabrics.

In the over-all program of research on the value of specific or individual physical and chemical properties of raw cottons, there is need for much more basic and systematic research to fully understand the value of fiber properties and the changes resulting from manufacture and usage factors which include such influences as are imposed by mechanical action, sorption history, finishing processes, oxidative conditions, and laundering. Hence, a systematically and symmetrically designed investigation should be undertaken in which cottons and cotton products would be thoroughly evaluated for physical and chemical properties at selected stages of manufacture and at intervals of application of treatments simulating usage of the end products. (New)(CRPG 197B)(UP 48/50)

B. CHEMICAL PROCESSING RESEARCH

1. Detection and Elimination of Dyeing Differences in Cotton Fibers -- Initiate research to determine the causes of light-dyeing spots in cotton goods and to develop means of eliminating them.

The presence of specks and light areas in cotton fabric is a recurring complaint from cutters and finishers, and causes much downgrading of cloth at a great cost to the entire industry. A simple, rapid, and nondestructive test for the early detection of these difficult-to-dye fibers is vital to the development of a suitable operation to eliminate them or to a suitable chemical treatment to overcome their differences. The solution of this problem would also create a more favorable market for the less mature cottons, since poor dyeability is probably their most objectionable feature. (New)(CRPG 200C)(UP 10/50)

2. Conduct Exploratory Research in Chemical Modification and Additive Finishing to Develop Improved Cotton Textile Properties.

The following approaches are suggested below in the priority order recommended by the Utilization Panel:

- (a) Modification of Cotton Textile Properties Through Polymerization Within the Fiber -- Conduct research to explore the effects brought about by the "in situ" polymerization of various monomeric materials within the cotton fiber.

Various monomers capable of penetrating the cotton fiber will be employed to impregnate cotton, and the monomer will be allowed or caused to polymerize within the fiber. It is anticipated that the fibers interpenetrated by such polymers would have new and useful properties such as improved elasticity and greater resistance to the degrading influence of solar radiation. Resultant products should be evaluated with special attention to any promising outstanding characteristic in the resulting fiber. (CCAC No. 23, 1955) (CRPG 105C)(UP 2/50)

- (b) Treatment of Cotton with High-Energy Radiations -- Initiate research to explore the practical effects of treating cotton with high-energy radiations.

Developments in the field of nuclear energy and radiations have provided scientists with new tools that offer possibilities for modifying the properties of cotton and giving it new and increased values. Direct application

of controlled dosages might improve certain physical (elastic) and chemical (dye receptivity) properties. Treatment of cotton with monomers followed by irradiation would cause polymerization within the fibers, thus changing the properties of the cotton. Application of polymers to cotton followed by irradiation should cause crosslinkage and impart certain desirable properties. (CCAC No. 30, 1955) (CRPG 151C) (UP 3/50)

- (c) Treatment of Cotton with Fluorocarbons -- Conduct studies on the treatment of cotton with fluorocarbons to improve resistance to wetting with aqueous and non-aqueous liquids and secure other useful properties.

Good resistance of cotton fiber to wetting by aqueous and non-aqueous liquids would constitute a valuable improvement, contributing to an improvement in stain and soil resistance and other important applications. Resistance to oily liquids would be especially valuable in clothing for use in automobile service stations, machine shops, etc. Some recent exploratory research has indicated that cottons treated with certain perfluoro acids gave very novel and potentially valuable properties, such as improved elasticity, good tensile strength and repellency. The market involved in this type of application is rather large. (Composite of CCAC Nos. 12 and 18, 1955)(CRPG 123C) (UP 9/50)

- (d) Chemical Modification of Cotton by Ethylenic Compounds -- Initiate work to explore the chemical modification of cotton by reaction with ethylenic compounds.

The familiar cyanoethylated cotton is a product made in this way from the ethylenic compound, acrylonitrile. It is proposed to study the underlying principles controlling such reactions with the objective of finding practical ways of reacting cotton with various kinds of ethylenic compounds. Special attention would be given to carrying out this type of reaction in the presence of sodium hydroxide or other bases in concentrations less than required to mercerize or greatly swell the cotton. Promising ethylenic compounds not available commercially would be synthesized for use in this work. Cotton that has been thus chemically modified would be evaluated for weather resistance, mildew resistance, heat resistance, improved acceptance of dyes or special finishes, and for other useful properties. (CCAC No. 22, 1955) (CRPG 106C) (UP 16/50)

- (e) New Cotton Products by Treatment with Epoxy Resins
-- Initiate application and evaluation studies of
commercially available and especially prepared epoxy
compounds, including epoxy resins.

Products showing promise in laboratory applications should be made in larger quantities for service tests. Some of the epoxy compounds are expected to polymerize within the fiber and some may yield only surface effects. Others may actually combine with the cotton cellulose. The immediate objective is to find new fibers with outstanding special properties, but the work will be done mainly on yarns and fabrics. (CCAC No. 9, 1955)(CRPG 109C) (UP 17/50)

- (f) Treatment of Cotton with Resins or Rubber Latexes --
Initiate study of the effects of resin and rubber
latexes toward improving the service life of cotton,
by applying them and systematically testing and
evaluating the properties of the products.

This research should lead to the economical transformation of cotton into useful specialty fibers, and enable it to compete advantageously with other materials for specialty uses, with constitute a steadily increasing market. Possible approaches include the application of commercially available monomers as well as polymeric materials, singly and in combination, to both untreated cotton and to cotton which has received preliminary treatments to make it more reactive or otherwise more amenable to modification with the latexes. (New) (CRPG 163C) (UP 23/50)

- (g) Treatment of Cotton with Silicone Resins -- Initiate
study of application of silicone resins to cotton,
and evaluation of the improved textiles thereby
obtained.

Improved treatments for resistance to wetting, soiling, and abrasion are needed. Commercial silicone resins would be used to determine the best application giving durability. Then, appropriate resins for specific purposes would be studied. Resins with free silanic hydrogen plus long chain groups should give softness and water repellency. Three dimensional polymers should give abrasion resistance. Hard, flexible resins capable of filling the "holes" on fiber surfaces should enhance soil resistance. (New) (CRPG 201C) (UP 24/50)

- (h) Better Elastic Properties for Cotton by Cross-Linking with Etherifying Agents -- Initiate research on improvement of the elastic properties of cotton by reacting it under alkaline conditions with difunctional etherifying agents which cross-link the cellulose.

Processing in this way will avoid the degrading effect on the cellulose caused by currently used cross-linking agents which are applied under acidic conditions. The purpose of improving the elastic properties in this way, while maintaining or improving other properties such as luster, is to impart dimensional stability, greater resilience and better drape. These properties are required for cotton to compete more effectively in large end-use markets, particularly for clothing. (New) (CRPG 165C) (UP 30/50)

- (i) New Cotton Products by Treatment with Aldehyde Resins -- Initiate study to explore the transformation of cotton into valuable new textile products by the application of modified aldehyde resins and related compounds.

During recent years the practice of treating cotton with aldehyde resins (urea-formaldehyde, melamine-formaldehyde, acetone-formaldehyde, etc.) has grown to the extent that the volume of cotton treated in this manner is equal to that of all the man-made fibers. While the treated cottons have improved hand, crush-resistance and rot-resistance, they need improvement with respect to water repellency and resistance to soiling, oils, flame and light. Probably these additional properties could be imparted easily by simple modification of the aldehyde resin applied to the cotton, i.e., by adding certain chemicals to the resin: Stearamide, cetylamine, rosin amine, and acetophenone for water repellency; polyfluoro amides, amines and ketones for resistance to water, oils and soiling; and phosphorous-, bromine- and antimony-containing compounds for flame resistance. (CCAC No. 16, 1955) (CRPG 110C) (UP 31/50)

- (j) Catalysts for Cellulose Etherification Reactions -- Initiate studies to develop catalysts which will accelerate and increase the degree of reaction of various etherifying agents with cotton cellulose.

Etherification provides many promising stable types of modification of cotton cellulose which could have many valuable applications. However, one of the principal problems encountered in the etherification of cotton cellulose is the inability to obtain substantial reactions with many ether-forming compounds, due to the heterogeneous

nature of the cellulose. The type of catalyst used is believed to be one of the major factors in the difficulty. A systematic investigation of known related catalysts is needed to reveal what valuable changes can be brought about by improvements in this field. (CCAC No. 20, 1955) (CRPG 124C) (UP 44/50)

- (k) Properties of Completely Substituted Chemically Modified Cottons -- Initiate studies to react cotton so that all of the hydroxyl groups in the cotton cellulose are completely converted to an ester, ether, or otherwise combined with the reactant, and evaluate the physical and chemical properties of yarns and fabrics obtained from such modified cotton.

Most chemical modifications of cotton which have been studied to any great extent are partial modifications in which only the hydroxyl, in the amorphous portions of the fiber, and those accessible groups presumably on crystallite surfaces, are reacted. Valuable as the properties of these cottons might be, they probably do not approach the changes which might be accomplished by a complete reaction with the cotton cellulose. Some studies conducted by SU indicate that cotton may be completely acetylated or cyanoethylated without losing its fibrous form or its fine structure skeleton. The properties of such completely substituted cottons promise to be strikingly different from either cotton or partially substituted cottons and should be investigated. (CCAC No. 29, 1955)(CRPG 148C) (UP 45/50)

- (1) New Textile Products by Application of Hydro- and Oleophobic Latices -- Conduct research on the application of latices containing hydrophobic and oleophobic polymers to cotton fiber to improve its physical properties and its competitive position in the textile market.

While cotton, a versatile fiber, still meets most needs of the textile industry (about 68%) it has been losing ground to specialty fibers in some fields where specialty properties are needed. If successful, the work envisioned in this proposal will improve such properties of cotton as its oil and water repellency, abrasion resistance, air permeability, dye fastness and soil and water resistance. This should aid cotton in its struggle to compete satisfactorily with other materials for specialty uses. The market involved is estimated at over 500,000 bale equivalents. (New) (CRPG 184C) (UP 49/50)

3. Improved Weather Resistance - Initiate research to determine the "protective" or "sensitizing" effect of various dyes in connection with investigating the weathering of chemically treated cottons.

Experiments have shown that certain dyes protect cotton against the weathering effects of direct sunlight while others sensitize or increase the degradation effects and still others are neutral or inactive. Data cannot be extrapolated from untreated to variously chemically modified cottons, as a specific dye may be sensitizing to untreated cotton and protective to a chemically modified cotton. Empirical data are needed of the effect of various dyes as "protectors" or "sensitizers" on different chemically treated cottons. Such investigations may extend our basic understanding of this protective and sensitizing effect and permit a prediction of the effect that would be produced by dyeing a certain modified cotton with a specific dye. (New) (CRPG 178C) (UP 38/50)

4. Determine Mechanism of Chemical Modification of Cotton Cellulose - Conduct research to develop a method for determining the relative degree of substitution in the crystalline and amorphous regions of cotton cellulose during chemical modification.

The daily increasing production of regenerated and synthetic fibers offers a serious challenge to cotton which can be met only by enhancing the good qualities already possessed by cotton, or giving it new characteristics. Chemical modification offers great possibilities for the accomplishment of these objectives. However, if it is to be achieved most economically and expeditiously, better methods of control and evaluation of the product must be provided. Success of the proposed research would provide additional means of identification and control of the amorphous-crystalline composition and, consequently, more definite progress and control in the improvement of such important physical properties as the tensile-elastic, abrasion resistance, and endurance. (CCAC No. 35, 1955) (CRPG 115C) (UP 50/50)

C. MECHANICAL PROCESSING RESEARCH

1. Analysis of Fiber, Yarn and Fabric Properties in Relation to Performance.

The following approaches are suggested below in the priority order recommended by the Utilization Panel:

- (a) Yarn and Fabric Structure vs. Tear Strength -- Initiate study to determine effects of yarn and fabric structure on tear strength.

Resistance to tearing is a basic requirement of fabrics in many industrial, household and apparel fields. To help cotton to meet increasing competition from nylon in these fields treatments are required such as resination, vinyl coating, etc., which reduce the normally acceptable tear strength. This reduction in tear strength of resin treated fabrics is caused by lowered yarn extensibility and by loss of reinforcement of one yarn by another. The effect of yarn structure on yarn breaking strength has been fairly well established as has the effect of variations in yarn structure on the breaking strength of certain fabric structures. However, comparable information on tear strength of fabric structures is very meager. It would seem, therefore, that a study of the effect of yarn and fabric structure on tear strength and certain recommendations which would come as a result of this study would be of advantage to cotton's competitive position. (CCAC No. 24,1955) (CRPG 36M) (UP 4/50)

- (b) Relation of Yarn Properties to Fabric Properties -- Conduct study to determine the effects of yarn properties on fabric properties.

The ultimate goal of this study is to find the relationships between yarn and fabric properties as a step in predicting fabric properties from known yarn properties. Also, conversely, information of this type should provide a basis for scientifically designing a yarn having properties suitable to meet specified fabric properties. Much of the work accomplished in this field has been theoretical in nature. Because of the many intangibles involved, it is proving difficult to transform theoretical expressions into practical usefulness. There is great need to supplement theoretical considerations with more direct empirical which would make fabric property prediction formulas work. Solution of this problem would tend to place textile manufacturing on an "Engineering" basis leading towards maximum utilization of cotton's potentials. (New) (CRPG 175M) (UP 12/50)

- (c) Measurement of Yarn Deformability -- Initiate research on the development of an instrument and method for measuring yarn deformability and correlation of this property with other yarn properties.

The deformability or softness of a yarn is known to have a major effect on other yarn properties such as breaking strength, elongation, knot strength, impact breaking strength, and also on fabric properties such as coverage; permeability to air, dust, and water; luster; drape; hand, dimensional stability, and abrasion resistance. Yet no method for the quantitative measurement of this property is available. The development of such a method would permit correlation of yarn deformability with important end-use properties and thus afford a fundamental basis for producing improved cotton textiles. (New)(CRPG 179E) (UP 21/50)

- (d) Relation of Fiber Properties to the Impact Breaking Strength of Yarns -- Initiate study to determine the effects of fiber properties on the impact strength of cotton yarns.

Resistance to impact is a basic requirement of textiles in many industrial, domestic and material uses. Since yarn impact strength takes into account collectively the strength and elongation properties of yarns and since recent data have shown that fiber elongation and yarn elongation are correlated, the relationships of fiber properties to yarn properties may be modified to give a better understanding of the relationship of fiber properties to product quality. In addition, cotton breeders should be provided with basic information on the contribution of fiber elongation to yarn properties and processing efficiency. (New)(CRPG 176E) (UP 28/50)

- (e) Compression Fatigue Test Method for Fibers. Yarns and Fabrics -- Initiate research to devise test method for measuring compression fatigue and determine construction of textiles for improved resistance to repeated longitudinal compression.

Many failures of textiles are due to in-service compressive forces rather than tensile forces, with the textile components of tires, belts, and outer fabric of canvas footwear, among others, failing primarily because of the action of compressive forces. If the cotton industry can be provided with a means for determining the optimum fiber properties and yarn and fabric structures for use where resistance to compressive fatigue is a requirement, the competitive position of cotton will be strengthened. (New)

2. Development of Automatic Blending Bale-Breaker -- Initiate research to develop a method and equipment for opening and uniformly blending cotton in the desired proportion from any desired number of bales.

Opening and blending of cotton always has been a serious problem and is especially important now that recent research has revealed the effect of fiber properties on processing efficiency and product quality. Because of the wide variation in the properties of cotton received by textile mills, the cotton from several lots must be blended in order to obtain a more uniform product. The method of blending now being used requires feeding cotton taken by hand from up to 100 bales to as many as 20 different machines. The effectiveness of this method depends largely upon the reliability and accuracy of unskilled labor, and it is recognized that satisfactory opening and blending is not being achieved. There is urgent need for a method and equipment that will insure the uniformly blending of the desired proportions of cotton from a number of bales. (New) (CRPG 170M) (UP 5/50)

3. Improved Spinning of Cotton Yarn -- Conduct research directed toward lowering cost and improving quality of cotton yarns by increasing spinning efficiency.

The following approaches are suggested below in the priority order recommended by the Utilization Panel:

- (a) New Method and Machine for Spinning Cotton Yarns -- Initiate research to develop a new method and machine without rings or travelers, for spinning and winding yarns into packages of any desired size.

Textile spinning machines presently in use have several undesirable qualities. Due to variation in tension on the yarn with both the buildup in the diameter of the bobbin and with the changing size of the yarn balloon as the ring rail rises and falls, the physical properties of the yarn are varied and result in non-uniformity. High rotational speeds of the bobbin which are required for twisting the roving into yarn limit the size of the yarn package which can be produced. The resulting relatively small package necessitates the addition of the rewinding operation with its attendant costs and added handling. A method of spinning which dispenses with the ring and traveler and which permits a yarn package of any desired size, will reduce manufacturing costs considerably by minimizing the doffing operation and will result in a product of improved quality. (New) (CRPG 209M) (UP 11/50)

- (b) Increasing the Productivity of Cotton Spinning Machinery -- Initiate research to lower the cost and improve the quality of cotton yarns by modifications of ring spinning machines that will permit increased production rates.

Production rates on present ring spinning machines are limited by a number of factors that also affect the quality of the yarn produced. Redesigning some of the basic parts of present spinning machines offers the opportunity of operating at much higher production rates without excessive wear or excessive number of ends-down. (New) (CRPG 210) (UP 40/50)

4. Determine Relation of Fiber Properties to Spinning Efficiency -- Initiate work to determine the finest yarn counts that can be spun effectively.

Spinning efficiency of a cotton is normally defined as the highest yarn number into which a cotton of a given fiber property combination can be spun efficiently, based on an arbitrary number of ends down per thousand spindle hours. In order to utilize fully the various properties of cotton fibers, it is necessary that the spinning limits of the domestic varieties be defined in terms of the fiber property -- spinning efficiency relationship, evaluated in terms of the spinning tension-ends down relationship which is the main criterion of efficient mill performance. The development of this relationship would expedite the introduction of new cotton varieties, improve the utilization of existing varieties, and integrate presently available information which is lacking in completeness, continuity and scientific development. (CCAC No. 15, 1955) (CRPG 125M) (UP 18/50)

5. Determine Effects of Short Fibers on Product Quality and Processing Efficiency -- Conduct study to determine the effect of cotton fibers shorter than 1/4 inch on product quality and processing efficiency.

It is generally believed that fibers shorter than 1/4 inch in a cotton fiber population directly influence overall processing efficiency, nep formation, yarn strength and uniformity, dyeing properties, and possibly, other quality characteristics. Since research studies, supplemented by mill experience, indicate that short fibers are undesirable, quantitative information is needed on the effect that fibers shorter than 1/4 inch have on product quality and processing efficiency. Among all textile fibers, short fibers are peculiar to cotton and any research that will overcome the difficulty of their presence will be of major importance to cotton. (CCAC No. 31, 1955) (CRPG 100M) (UP 19/50)

6. Improved Method for Forming Picker Laps -- Initiate work to develop ways of producing better picker laps.

Conventional cotton textile pickers form laps by squeezing batts of cotton between high-pressure calender rolls. This manner of producing laps results in non-uniform density,

unequal adherence of layers of cotton, splitting and tearing. Subsequent processes are dependent upon a smooth coherent lap in order to produce high quality textile products. There is great need to develop improved equipment for forming cotton picker laps by improved calendering or some other method, without damage to the fibers and at production rates considerably higher than heretofore possible. (CCAC No. 13, 1955) (CRPG 137M) (UP 25/50)

7. Determine Effects of Processing on Cotton Fiber Length Distribution -- Initiate research to determine effect of each operation in textile processing on fiber length distribution.

Examination of an array of cotton waste fibers extracted by normal processing methods, reveals striking evidence that a percentage of relatively long, spinnable fibers is extracted. Studies of yarns show the presence of undesirable short fibers. Although there is some selective separation of wanted and unwanted fibers, in normal processing, there is no information on the extent of this separation at the various manufacturing stages. Cotton, which contains a percentage of short fibers, should benefit from a study which would evaluate cleaning actions as a basis for the development of better processing machinery. (New) (CRPG 145M) (UP 26/50)

8. Explore Aerodynamic System for Parallelizing and Conveying Cotton Fibers in Drafting -- Initiate research to develop equipment for parallelizing cotton fibers and conveying the fibers from the card to the spinning frame.

Drafting systems composed of rolls and/or aprons for parallelizing cotton fibers is one of the oldest processes in use by the textile industry, and one which requires considerable mechanical processing equipment. Since extended processing tends to decrease fiber length and to increase neps, an aerodynamic system which would parallel and convey the fibers from the card to the spinning frame would have the effect of increasing yarn strength and other quality factors, and saving 17 to 24% in floor space. Since 27% to 39% of the total cost of spinning cotton is consumed in the drawing and roving operations, including the handling of sliver cans, a system without these processes would result in a major reduction in manufacturing costs. (New) (CRPG 206M) (UP 32/50)

9. Determine Effects of Lowered Relative Humidity on Nep Formation -- Initiate research to determine the possibility of reducing neps during carding by reducing the relative humidity to below those in commercial use.

Neps, which are largely peculiar to natural fibers, are a source of much loss in manufacturing efficiency and lowered quality in cotton products. In present cotton mills an artificially high

humidity is maintained as an aid to processing, particularly in the control of static electricity. Studies have indicated that there is a decrease in nep formation at lower humidities than those under which most present mills operate. Research which would evaluate the reduction in neps obtained and develop methods for manufacturing under lower relative humidities would result in higher quality cotton yarns and fabrics which could be manufactured at lower costs. (CCAC No. 31, 1953) (CRPG 59M) (UP 33/50)

10. Develop Equipment for Warp Knit Cotton Fabrics -- Initiate research to design and develop equipment for economic, high-speed production of warp knit fabrics from untreated, standard construction cotton yarns.

Weaving is the most expensive single process in the production of cotton fabrics. The cost of knitting is known to be significantly below that of weaving. Cotton yarns have long performed satisfactorily on circular knitting machines, but have been unaccepted on warp knitters because of excessive yarn breakage. The recent development of higher speed warp knitting machines has given a tremendous advantage to continuous filament synthetic yarns over cotton yarns for knitted goods. Warp knit synthetics are now being experimented with for bed sheets, pillow cases and drapes. These developments will further decrease the demand for cotton fabrics. A warp knitting machine that can satisfactorily knit cotton yarns at high speeds will definitely aid in maintaining and expanding the market for cotton. (New) (CRPG 207M) (UP 39/50)

D. PRODUCT OR PROPERTY DEVELOPMENT

1. Develop Stretchable Cotton Yarns for Socks and Other Knitware -- Initiate research to develop Helanca-type stretchable cotton yarns.

By suitable twist manipulation and fiber setting, highly stretchable and elastic yarns for knitted garments have been made from synthetic fibers, especially nylon. The objective is to make cotton products with similar properties. A suggested approach is to impart a high twist to cotton yarn; to treat the twisted yarn with a suitable setting agent such as a resin with elastic but not too great adhesive properties; and finally to untwist to a controlled degree. Permanent crimp and opening of twist are expected to impart the desired elastic properties. (CCAC No. 19, 1955) (CRPG 149P) (UP 6/50)

2. Permanent Crease Retention for Cotton Clothing -- Initiate research to develop a means of imparting a permanent crease in cotton clothing articles.

In such articles of clothing as men's suits and trousers and women's pleated skirts, a sharp crease is often necessary. A garment's serviceability frequently depends on the ability of the fabric to take and maintain such a crease. Blends of wool with synthetic fibers are rapidly increasing in popularity because of their improved crease retaining characteristics, particularly during humid weather. The development of satisfactory methods of inserting sharp creases in cotton clothes that would remain even in damp weather would greatly benefit cotton's competitive position in many clothing uses. (New) (CRPG 187P) (UP 13/50)

3. Develop a Non-Wicking Cotton Chafer for Tubeless Tires --
Initiate research to develop a cotton fabric which will not transmit air from the interior of tubeless passenger car tires.

In present tubeless tires, spun cotton yarns in the chafer fabrics "wick" air from the interior of the tire into the tire carcass. There is also some transmission to the outside of the tire where the air escapes. Wicking of air into the carcass forms a blister, then a ply separation, and results in failure of the tire. Tire manufacturers' efforts to control this problem have developed the use of monofilament nylon or rayon, substitution of cured rubber strips for chafer fabrics, or chemical treatment of square-woven rayon chafers. Rayon is more receptive to agents which act as air barriers because it contains none of the natural waxes which inhibit these applications on cotton fabrics. Development of a chemical treatment or method of manufacture which would prevent wicking in cotton chafers should help retain this market of 137,000 bales per year. (New) (CRPG 185P) (UP 20/50)

4. Explore Development of Cotton Felts -- Initiate work to explore the possibilities of the production of satisfactory felts from cotton.

It is recommended that the possibility of making useful cotton felts be explored. The following sequence of operations would be employed: (1) formation of batts of suitable thickness from card webbing or random cotton webbing, (2) needle punching the batts until the desired degree of hardening and entangling has been obtained, and (3) slack mercerization of the hardened batts, washing, and drying. These products would be thoroughly evaluated, compared with the available wool and synthetic felts, and checked against existing felt specifications. (New) (CRPG 166P) (UP 27/50)

5. Explore Development of Woolen-type Cotton Fabrics -- Initiate research to explore approaches leading to development of woolen-type cottons.

Loftiness, unevenness, and non-parallelization of fibers are characteristics of yarns produced on the woolen manufacturing

system. Woolen-type yarns produce a fabric which cannot be duplicated in appearance or cost on either the worsted or cotton systems. The characteristic "woolen" fabric has a well established place in women's fall and winter clothing and in men's sport jackets. Cotton fabrics if produced by this system, might prove to have advantages in coolness and washability over other materials. As a result, cotton might compete in markets now held largely by wool and man-made fibers. (CCAC No. 34, 1955) (CRPG 141P) (UP 34/50)

6. Cotton with Reduced Water Absorbency -- Initiate research on the development of cotton products having reduced water absorbency.

Products of this type should possess improved utility for a number of uses, including drapery, bags, rugs, and carpeting, electrical insulation, laundry nets, fishing supplies, and tablecloths. Low absorbency speeds drying, contributes to soil and stain resistance, and improves dimensional stability. A significant strengthening in cotton's markets might result from this work. (CCAC No. 33, 1955) (CRPG 32P) (UP 41/50)

7. Improved Wash and Wear Fabrics from Cotton -- Initiate work to develop better techniques for obtaining wash-and-wear cottons without altering the durable and comfort properties of cotton.

Recovery of tear strength and abrasion resistance of treated samples by use of alkali and softeners would be investigated. Effect of length of cross-links would be determined. Alkyd resins containing hydrophilic groups would be studied to aid in the wet recovery of the fiber or yarn. Carboxymethyl or hydroxyethyl cotton would be considered, as starting fabric, also as an aid in wet recovery. Proper selection of resin would be made to minimize or eliminate, if possible, retention of chlorine in laundering when bleach is used. (New)
(CRPG 167P) (UP 46/50)

E. SERVICEABILITY (No work proposed)

F. EVALUATION METHODS AND EQUIPMENT

- * 1. Develop Rapid Fiber Sorter for Estimating Length Distribution of Cotton Fibers -- Initiate research on the development of an instrument for rapidly sorting cotton fibers according to length, thus providing means for quickly rating or comparing cottons according to fiber-length distribution.

Length distribution is a measurable property of cotton and one of the most important determinants of its commercial utility. Preparation of a length array provides the most complete and reliable data for comparing the lengths of different cottons,

but the classical test is so time-consuming and laborious that it is used only in exacting research. More rapid optical and semi-mechanical methods are in use, such as the Fibrograph and the Uster Staple Diagram Tester, but they measure this property indirectly, do not give complete data, and are relatively time-consuming. A rapid test in which length arrays are approximated --- as for example, by automatic sorting from a combed blended specimen --- would be of definite value to industry and research for selecting cottons for particular end uses. (New) (CRPG 214E) (UP 7/50)

- *2. Develop Improved Clamps for Holding Flat Bundles of Cotton Fibers for Strength Tests -- Initiate research to develop a satisfactory clamping mechanism for holding flat bundles of cotton fibers for strength and elongation tests.

The type of clamps used in all types of flat-bundle testing machines have several defects that add to variability of the results and the cost of testing. Each set of clamps has its own characteristic behavior, which means that many of them give measurements at different levels, and there is a progressive change in this level with time when new clamp facing material is inserted. Daily, and sometimes more than once daily, calibration is required. The development of a set of clamps free of these and associated defects would be of tremendous value in breeding and utilization research and in the merchandising and utilization of cotton. (New) (CRPG 211E) (UP 14/50)

- *3. Improved Cotton Blender for Preparing Samples for Fiber Tests -- Initiate research for the development of an improved cotton blender for rapidly and economically preparing homogeneous samples of cotton from which specimens may be drawn for fiber tests with full confidence of uniformity and representativeness.

With the constantly increasing use of instrumental methods for measuring the fiber properties of cotton and the necessity for obtaining results promptly, more rapid means are needed for thoroughly blending samples with a minimum of breakage, preparatory to taking the test specimens. Application of the newer knowledge of mechanical and aerodynamical principles appear promising for the development of an efficient blending procedure which would be more rapid (less than 30 seconds per sample) and less tedious than the classic hand sliver or present mechanical blending methods. The method would have the additional advantages of reduced cost of testing for research, marketing and utilization purposes, reduced number of tests required, and reduced variations between test results for a single property. (New) (CRPG 195E) (UP 42/50)

Other "instrumentation" work contemplated includes the following which may be considered as tools necessary, or at least appropriate, to the conduct of the research in the subject heading indicated. These

proposals are listed here for informational purposes and for comment. Contrary to Nos. 1-3 above, which are recognized as of wider interest (outside Utilization Research), these four proposals seem to be rather specifically related to Utilization problems.

Measurement of Yarn Deformability -- Initiate research on the development of an instrument and method for measuring yarn deformability and correlation of this property with other yarn properties (No. 1-c under mechanical processing research).

Relation of Fiber Properties to the Impact Breaking Strength of Yarns -- Initiate study to determine the effects of fiber properties on the impact strength of cotton yarns. (No. 1-d under mechanical processing research).

Compression Fatigue Test Method for Fibers, Yarns and Fabrics -- Initiate research to devise test method for measuring compression fatigue and determine construction of textiles for improved resistance to repeated longitudinal compression. (No. 1-e under mechanical processing research).

Crystalline-Amorphous Cellulose Ratio by the Nuclear Magnetic Resonance Technique -- Conduct research to determine the usefulness of nuclear magnetic resonance as a principle on which to base a sensitive and rapid method for evaluation of crystalline and amorphous cellulose. (No. 1-d under basic cotton fiber research).

COTTONSEED AND COTTONSEED PRODUCTS

A. FOOD USES FOR COTTONSEED OIL

1. Cottonseed Oil and Pigment Isolation and Removal -- Expand fundamental research on the chemistry of pigments of cottonseed oil, including research on the properties and reactions of gossypol, to provide basic data and information to guide the production of oil and meal of higher quality.

Development of simpler, better procedures for removing color will serve to strengthen the competitive position of the oil for edible purposes. Although considerable information is known about the principal pigment, gossypol, little information exists concerning its transformations into other pigments during processing of the seed and oil. Likewise, little is known about other pigments, originally present in the seed or formed during processing, which may significantly affect the pigmentation and stability of the oil. (CCAC-55-2/27) (UP 2/23)

2. Measure of Coloring Substances in Cottonseed Oil -- Initiate research on the development of a practical method of measuring the quantities of the several coloring substances in cottonseed oil for use as a guide to refining and bleaching of the oil.

Color is one of the quality factors economically important in marketing and processing cottonseed oil. The present and long used method of estimating color is based on arbitrary principles and gives little or no information on the character of the pigments present. A new method of color evaluation, based on physical and chemical principles and designed to indicate the kind and amount of coloring substances present, is needed to provide a more realistic and useful basis of measurement. (CRPG-C/S-No. 34) (UP 6/23)

3. Enzymatic Hydrolysis of New-Type Fats -- Initiate research on the development and application of an in vitro method of testing normal and modified fats to more rapidly establish the digestibility of modified fats as well as heat damaged oils.

Processed and new fat products must eventually be tested in animals for digestibility, but prior to such tests a rapid in vitro test for digestibility is needed to aid in the efficient development of the best product. A relatively simple test with an enzyme would be expected to provide a preliminary answer and save valuable research time and effort, as well as providing valuable information about the chemical linkages which may affect digestibility and hence the nutritive value of fat products derived from cottonseed oil. (CRPG-C/S-No. 42) (UP 10/23)

4. The Effect of Processing on the Composition of Cottonseed Oil as it Relates to Nutritive Value -- Initiate research on the changes in composition of the glycerides and minor components of cottonseed oil resulting from processing operations such as

refining, bleaching, deodorization, and hydrogenation; from uses such as in deep fat frying and baking; and from chemical modification to produce new fat products.

There is increasing interest among nutritionists and medical authorities on the effect of the type of fat in the human diet on predisposition to certain diseases such as cardio-vascular diseases and on longevity. Cottonseed oil is one of the major edible oils. Changes may take place in the oil during processing and utilization which could either have a beneficial or detrimental effect on public health. Information is needed to make possible control of changes during processing and use so as to achieve maximum nutritional benefit from cottonseed oil. (UP 13/23)

5. High-Energy Irradiation of Cottonseed Oil -- Initiate exploratory study of the effect of high-energy irradiation of cottonseed oil, purified glycerides, and pure fatty acids on their physical characteristics, reactivity, biological activity, and stability as part of the broad program on increasing the utilization of vegetable oils now in surplus.

The irradiation of glycerides is known to have some effect on their components. The object of the proposed research is to establish quantitatively the effect of type and amount of irradiation on cottonseed oil and each of its components. The information obtained is expected to indicate the changes in composition of cottonseed oil and its components caused by irradiation and under what conditions cottonseed oil can be used in products that are to be subjected to irradiation without damage to stability, flavor, or nutritive value. (CCAC-55-27/27) (UP 14/23)

6. Neutral Oil Content of Cottonseed Oil -- Initiate investigations to develop and establish a rapid and practical method for determining the neutral oil content of crude cottonseed oil to objectively evaluate the potential yield of refined oil.

The development of a rapid and practical method for determining neutral oil may be considered part of a program for the development of a system of objective methods for the characterization of cottonseed oil. They should serve both research and industrial purposes and may eventually be used for market evaluation of commercial oils. As the refining of oils becomes more automatized, there would seem to be a definite need for the most objective evaluation of the characteristics of the crude oils. (CRPG-C/S-No. 35) (UP 15/23)

B. INDUSTRIAL USES FOR COTTONSEED OIL (No Work Proposed)

C. COTTONSEED MEAL AND PROTEIN

1. Processing vs. composition of Cottonseed Protein -- Expand research to determine the effect of heat and other conditions of processing on amino acid composition of cottonseed protein.

Chromatographic techniques now available permit estimation of individual amino acids. With such analytical tools available, it is possible to check on fate of individual amino acids under different conditions of processing. The results being obtained shed light on the nature of changes effected by processing and assist in the development of improved processing procedures. (CCAC-55-3/27) (UP 3/23)

2. Digestion and Metabolism of Gossypol -- Initiate investigations on the biochemistry of the digestion and metabolism of gossypol and its derivatives and modification by poultry and swine.

The information to be obtained is basic in guiding the research on the treatment and processing of cottonseed for the production of meals that will not cause egg-yolk discoloration when fed to laying hens. In addition, basic information should be obtained on the physiological action and metabolic fate of gossypol when resorbed from the digestive systems of swine and poultry. With full knowledge of the physiological action of gossypol and its derivatives, the overall program of improving the utility of cottonseed as a feed will be greatly benefited. (CCAC-55-23/27) (UP 8/23)

3. High-Energy Irradiation of Cottonseed Protein -- Initiate exploratory investigations to determine the effect of high-energy irradiation on the nutritive value of protein and on the destruction of toxic or other materials that reduce the nutritive value or utility of the meal in feeds for all classes of livestock.

Irradiation is expected to cause or accelerate such changes as protein denaturation and reactions of unwanted pigments with the protein. Before the practical value of irradiating cottonseed meal can be known fully, cottonseed protein should be irradiated alone, and in the presence of other added meal constituents (e.g. pigments) and determinations made of the effect of irradiation on protein solubility, gossypol and gossypol derivative contents, amino acid composition, and nutritive value for domestic animals. (CCAC-55-26/27) (UP 16/23)

2. COTTONSEED AND COTTONSEED OIL PROCESSING

1. Higher Quality Oil and Meal Through Improved Cooking Methods and Through Removal of Gossypol -- Expand studies to determine the influence of methods of cooking upon quality of cottonseed oil and meal and to develop information on a pilot-plant scale which can be translated to commercial operations.

Laboratory cooking experiments have shown that it is possible to produce oil of lighter color and meals of much higher solubility and nutritive value than are produced by commercial operations. Suitable cooking effects improvement through removal and/or inactivation of gossypol, thus eliminating a constituent responsible for restricting the use of cottonseed meals in poultry feeds. Further work on a laboratory and pilot-plant scale would furnish meals for quality evaluation and engineering data to guide the selection of mill-scale processing equipment and procedures. (CCAC-55-1/27) (UP 1/23)

2. Minor Constituents in Cottonseed and Cottonseed Products -- Initiate research to investigate and further characterize the minor constituents in cottonseed and products systematically, and to develop reliable rapid methods of analysis of those

known or found to influence quality of products.

Research on improving the quality of products is constantly confronted with the need for knowledge of the presence and variations in the amounts of minor constituents. Hence, research should be initiated not only to investigate and further characterize the minor constituents in cottonseed and its products systematically, but also to develop reliable rapid methods of analysis of those known or found to influence the quality of products. Among those of immediate interest are simple and complex sugars, glucosides, phosphatides, sterols, carotenoids, and organic acids. The variation in the amounts that may be present should be determined. The information should form a basis for improving both processing and utilization research. (CCAC-55-24/27) (UP 4/23)

3. Composition of Cottonseed Gums and Properties of Cottonseed Phosphatides -- Initiate investigations of the composition of gums obtained by water washing cottonseed oil, to develop means of separating and purifying gossypol and phosphatides found in them, and to compare the properties of the phosphatides with those commercially available.

Cottonseed gums present a potentially large and convenient source of both gossypol and cottonseed phosphatides (lecithin). Gossypol is known to have antioxidant and antipolymerization properties and doubtless would find commercial utility at competitive prices. Other vegetable oil phosphatides, e.g. soybean phosphatide, have extensive commercial use, e.g. as emulsifiers, in grinding paints, etc., and cottonseed phosphatides may be expected to have similar uses and to be superior for certain purposes. For example, the absence of linolenic acid (present to the extent of 5 to 10% in soybean phosphatides) should result in less discoloration (after yellowing) of paint films on ageing. (CRPG-C/S No. 38) (UP 19/23)

4. Application of Ultrasonics and Induction and Dielectric Heating to the Processing of Cottonseed and Cottonseed Oil -- Initiate studies on the application of ultrasonic wave energy as a means of comminution and cavitation and of induction and dielectric heating in improving the processing of vegetable oil-bearing materials and their oil and meal products.

The application of ultrasonic principles and of induction and dielectric heating introduces new approaches for improving the processing of vegetable oil-bearing materials and their products. The experimental application of ultrasonic waves may develop information for devising new and improved extraction, refining, and bleaching methods. This could result in the production of protein meals of high feeding value with little or no gossypol; the production of oils of light color and improved stability; improved efficiency of water-washing and degumming of oils; and better removal of linters. It is important to evaluate the application of new techniques to processing of cottonseed. (CRPG-C/S No. 37) (UP 23/23)

E. COMPOSITION OF COTTONSEED AS RELATED TO UTILIZATION

1. Irradiation of Cottonseed to Improve Yield and Quality of Products -- Initiate research to determine the improvement in the yield and quality of cottonseed products by high-energy irradiation of the seed reserved for deferred processing at cotton oil mills and to determine the practical value of such irradiation.

Deterioration of cottonseed prior to processing causes large monetary losses through disappearance of oil, accumulation of free fatty acids, and lowering of the quality of the oil and meal. Irradiation has been found effective for retarding the spoilage of packaged foods. To ascertain whether irradiation can effectively retard seed deterioration by microorganisms and seed enzymes without inducing detrimental effects, prime cottonseed should be irradiated, stored, and compared with suitable controls in regard to its processing characteristics and the quality of the derived oil and meal. (CCAC-55-9/27) (UP 9/23)

2. Chemical Treatment of Cotton Plant in Field to Prevent Deterioration in Seed -- Initiate research in cooperation with other Federal agencies, with State experiment stations, and with private companies on the effect of treatment of the cotton plant with chemicals at time of defoliation upon field damage and the storage properties of cottonseed.

Since deterioration of cottonseed appears to start in the field prior to harvest, treatment of the plants with chemicals (e.g. maleic hydrazide) prior to harvesting offers promise of retarding deterioration of the seed after harvest and of reducing the heavy monetary losses resulting from such deterioration. To ascertain the practical value of such treatments, seed should be obtained from chemically treated plants and from untreated controls and the seed conditioned for varying periods before being evaluated for processing characteristics and for oil and meal quality. If chemical treatment of the plants is successful in reducing seed deterioration, the value of the cottonseed crop at the time of processing will be significantly increased. (CCAC-55-13/27) (UP 11/23)

3. Mechanism of Deterioration in Microorganism Sterile Cottonseed -- Initiate work to determine the storage behavior of microorganism sterile but viable cottonseed in order to assess properly the role of seed enzymes and of microorganisms in the deterioration of seed during storage.

Cottonseed undergoes continual deterioration when stored under conditions that prevail in warehouses and mills in many sections of the cotton belt. It has never been possible to assess the contribution to this deterioration that results from normal physiological changes in seeds because such changes are masked by deteriorative changes resulting from the growth of microorganisms. Microorganism-sterile seed could be grown

in sterile surroundings and tested under sterile conditions. A determination of compositional changes (e.g. free fatty acid formation) and heating effects produced in both sterile and in inoculated seed could throw much light on the cause and mode of deterioration in viable cottonseed. (CCAC-55-20/27) (UP 20/23)

4. Reducing Deterioration of Cottonseed at the Mill -- Initiate research on the effectiveness and economy of employing temperatures in the range of 35° F. to 50° F. and moisture content in the range of 7% to 10% as a means of reducing losses at oil mills owing to deterioration in the seed.

Annual losses attributed to formation of free fatty acid by seed deterioration during storage have been estimated at about 5 million dollars. It is anticipated that 50 to 75% of this loss could be avoided by use of refrigeration during storage. Preservation of cottonseed at mills to extend the processing season continues to be a problem in the more humid areas. Reducing the temperature by refrigerative cooling and holding the seed at the lower temperatures is an approach that has not been fully evaluated against present use of ambient air for cooling. Preliminary calculations indicate that this approach is not only feasible but economical. That cottonseed can be preserved indefinitely with minimum change when held at 33° F. and at less than 8% moisture has already been demonstrated on laboratory scale. (CCAC-55-21/27) (UP 22/23)

F. UTILIZATION OF LINTERS AND HULLS

1. Cleaning Cottonseed at Oil Mills to Improve Linter Quality -- Expand research on the development of new and improved methods of cleaning cottonseed at the oil mill to facilitate processing and improve competitive position of linters by providing a cleaner, higher grade product.

The increase in rough hand-picking and in mechanical harvesting of cotton has imposed new cleaning problems on the oil mill. Several new techniques, including a dual-belt machine to project cottonseed and its contaminants at a high speed into still air, have been tested in a preliminary way and appear promising for removing different types of foreign matter from seed. Additional personnel are needed to prosecute this work effectively. The development of practical methods for maximum cleaning of seed on a quality basis would facilitate seed processing and improve competitive position of linters by providing a cleaner, higher grade product. (CCAC-55-7/27) (UP 5/23)

2. Determination of the Utilization Potential of Cotton Linters -- Initiate research to determine the most important physical and chemical properties required, especially for nonchemical uses, and to establish the potential value of linters for various uses.

Research to improve potential markets for linters, especially in non-chemical uses, requires knowledge of the most important physical and chemical properties needed for various end uses. In the various fields of uses such as for bedding, automobile batts and pads, and furniture felts and stuffing, linters are encountering increased competition from other materials. In cooperation with the Agricultural Marketing Service representative at the Southern Utilization Research Branch the following surveys will be carried out: (1) Determination of the potential market for linters especially in non-chemical uses such as in paper manufacture; (2) determination of the most important physical and chemical characteristics required of linters for present and projected uses; (3) determination of the potential value of linters in various present and projected uses; and (4) determination of the more important present research underway on utilization of linters. The information obtained will help to direct the future research program of SURB on linters, particularly for non-chemical uses. (CRPG-C/S-No. 53)(UP 7/23) (Note Market Res. Proposal on Det. Mkt. Potential of Linters)

3. Chemical Composition and Properties of Cotton Linters -- Initiate research to obtain information on the chemical composition and properties of linters of different varieties, growths, and grades to serve as a basis for increasing utilization.

Very little is known of the nature and amounts of the constituents present or of their influence on the properties of cotton linters. Since such information is fundamental to solving problems connected with the utilization of any commodity, the chemical composition and properties of cotton linters should be investigated. Attention should also be given to the reactivity of cotton linters as influenced by the minor constituents present and treatments used in their removal to produce purified linters. (CRPG-C/S-No. 47) (UP 12/23)

4. Improvement of Cotton Linters for Papermaking -- Initiate research to develop a cotton linter pulp having characteristics suitable for papermaking by application of new approaches to fiber hydration.

Research is urgently needed to increase the use of linters in papermaking. The paper industry is in need of a dependable source of cellulose fibers for the "rag content" papers, and linters would make an ideal raw material if properly processed. The present raw materials such as cotton cuttings are being contaminated with synthetic fibers which are not suitable for papermaking. The use of linters for papermaking requires that a method be developed which will hydrate and fibrillate the linters without excessive cutting and degradation. Two refining units developed recently by industry have possibilities of preparing linters without excess degradation. Work of this type will be carried out cooperatively with the company or companies having the most promising equipment, or if feasible and desirable, by contract. (CRPG-C/S-No. 48) (UP 17/23)

5. Microscopical Investigation of the Structure and Composition of Cotton Linters -- Initiate studies to obtain fundamental information on the microscopical and submicroscopical structure and physical composition of cotton linters to promote utilization, particularly non-chemical uses.

Since internal fine structure is a basic property of linters for all applications, except for dissolving, studies will be undertaken to reveal this with the aid of the light microscope, using the techniques of swelling, cross-sectioning, staining, double refraction, photography, x-ray diffraction, etc. Using various means of mechanical disintegration and fragmentation, the electron microscope will be applied with the aid of direct and replica micrography. Observations will be repeated at different stages of hydration and purification. (CRPG-C/S-No. 46) (UP 18/23)

6. Swelling and Hydration of Cotton Linters -- Initiate research to improve properties and reactivity of cotton linters by treatments involving fibrillation, hydration, and swelling of the fibers.

This research would include subjecting samples of linters to beating and refining by various commercial procedures using conventional and recently developed equipment. Equipment will be used which will give maximum linters fibrillation ("opening up" of linters), hydration, and swelling with the minimum of cutting. Linters processed in this manner should be more reactive to chemical treatment for the production of new and more useful products. This work would be carried out cooperatively with institutions having the experimental beating and refining equipment. (CRPG-C/S-No. 49) (UP 21/23)

III. MARKETING RESEARCH

(Listed in order of priority determined by Marketing Panel)

Fiber and Fiber Products

- *1. Effect of Wetting Agents, Oils and Water Used in Mechanical Picking and Ginning on the Spinning and Finishing Performance of Cotton -- Initiate research to ascertain the effect of wetting agents, oils and water used on spindles of mechanical pickers and in ginning on the formation of so called "spindle twist" and on the spinning and finishing performance of cotton.

The research should include analyses of materials commonly used for this purpose as well as controlled experiments to ascertain the concentration and conditions under which adverse effects occur. The work would be coordinated with research on the effect of these materials on picking and ginning efficiency. (See also corresponding Production Research Proposal concerned with determining effects of these additives on ginning) (New)

2. New Cotton Bale Wrappings -- Initiate a study to collect economic data to show the need for better packaging and to develop facts upon which to make recommendations regarding adjustments for tare and other problems incident to the possible adoption of new packaging materials.

The present poorly wrapped and frequently cut bale cover gives little protection to the lint, resulting in contamination of all kinds between gin and mill. It also gives rise to many complaints from mill customers--domestic and foreign--and is quite unfavorable compared to bales from other countries. The cost to cotton mills in conditioning these bales before use is substantial, both in loss of good lint and in labor of reworking the bale. Uncoated bands which rust quickly also cause rust contamination. Poorly applied bands and buckles cause breakages and distortion of bales which are costly to repack and give much trouble in handling and storage.

A current research program on better packaging, developed and conducted by the industry, appears to be making progress. Most of the new covers are of much lighter weight than the present jute bagging, creating problems of tare adjustment. Some are water-proof, some are not. These and other problems arising from departure from traditional bagging and ties need to be analyzed from the standpoint of their costs compared with the existing wrappings and their impact upon various trading practices. (1955 7/14)

3. Value and Use of Fiber Testing in the Marketing of Cotton -- Initiate a study to determine the nature and extent of the use of cotton fiber tests at various stages in marketing and the economic effects of these tests on each of the major segments of the domestic cotton industry, and to indicate something of the possibilities of and the extent to which more effective use of fiber testing may contribute to further efficiencies in the production, marketing, and utilization of American cotton.

Tests for cotton fiber properties such as strength, length, fineness, and maturity have been employed to a considerable extent by cotton spinners and breeders for some years, but few shippers have made use of specific fiber test results in buying and selling raw cotton until recently. The economic importance to the cotton industry of mechanical and chemical means of measuring cotton properties merits study from the standpoint of their effects on marketing methods and practices, and the need for and feasibility of providing more effective use of fiber testing in the production and marketing of those qualities and types of American cotton which will most effectively meet the needs of mills and of ultimate consumers. (1955 - 4/14)

4. Improved Methods of Sampling Cotton Bales -- Expand that phase of the work relating to the automatic sampling of cotton bales to provide additional information on the nature and extent to which the use of such a sampler and of mechanically drawn samples affects the costs and practices of cotton ginners, merchants, warehousemen, and spinners.

This information will indicate some of the main advantages and disadvantages of this method of sampling cotton bales and help determine whether or not it is adaptable to other gins and other parts of the Cotton Belt. The study may also indicate desirable changes in the samplers and in the method of handling the samples.

Information already available indicates that at least under certain conditions, the automatic sampler and the resulting samples will (1) provide a sample representative of cotton throughout the bales, not just the thin outer portion of each side, (2) reduces the amount of sample cotton removed from the bale, and (3) reduces the extent to which the bale covers are mutilated and the exposed portions of the bale are subjected to damage from excessive weathering and from such foreign materials as sand, dirt, tar, and oil. The widespread use of this method of sampling would, therefore, represent an important improvement in American cotton and strengthen its comparative position with foreign cottons, synthetic fibers, and other products. (New)

5. Analysis of Foreign Synthetic Fiber Competition -- Expand research on foreign synthetic fiber competition as it relates to the demand for U. S. cotton.

It is planned to make a reconnaissance of the foreign synthetic fiber industries in Western Europe in 1956 as soon as feasible and after that a similar survey will be made in Japan. The purpose of these initial surveys will be to obtain factual information on all aspects of synthetic fiber production, distribution, composition, procedures, and utilization along with Government policies relating to the industry. (1955 1/2 - MS & EW)

6. Costs and Associated Problems of Shippers in Marketing Raw Cotton -- Initiate work to determine the costs and associated problems of raw cotton merchants or shippers in marketing raw cotton and analyze the costs incurred as they relate to the services involved to indicate ways and means of reducing costs without adversely affecting the number or quality of the essential services.

Increasing amounts and the complicated nature of cost items in merchandising cotton are the basis for some of the major problems of American cotton shippers. At present no adequate data are available on the amount and composition of merchants' costs. The evolution that is under way in cotton merchandising because of new methods of classification has created a new set of conditions in the purchase and sale of cotton. New cost items associated with claims with respect to quality and possible bale irregularities are said to be increasing. Changes in methods of trading which bear on costs have occurred and need to be investigated. These and other considerations point up the need for accurate data on the costs and composition of costs at different levels of operation. The problems are of increasing importance to the industry as a whole, and are especially so in the case of small- and medium-sized cotton shippers, as they bear on the efficiency of the raw cotton merchandising system. (1955 9/14)

7. Fiber Preferences in Industrial Textiles -- Initiate an industrial use and preference survey to determine the competitive position of cotton and other fibers in an appropriate industrial end use market.

The practice of making one or two yearly studies of industrial consumers of cotton should be continued. The particular industries to be studied are selected largely on the basis of their present or potential importance as consumers of cotton. This selection is made after consultation with those in industry and in trade organizations who are in position to provide sound advice. Under present consideration are studies of retail piece goods at the finishing level, textiles in shoe manufacture, surgical dressings and conveyor belts. The next selection probably will be made from these four. (1955 3/14)

8. Fiber Preferences in Household Textiles -- Initiate a consumer use and preference survey regarding the competitive position of cotton and other fibers in household furnishings.

Segments of the industry have suggested the need for a survey of homemakers' experience with and preferences for the various new and improved fibers used in selected household textile items. These products have been on the market long enough for a consumer study to yield valuable results, and it is time to find out how satisfied the consumers are who have experimented with non-cotton fibers. Particular attention will be given to such household items as blankets and rugs because of the considerable inroads which the manmade fibers have made in the past years.

The continuing growth in the use of synthetic fibers in household goods partially at the expense of the natural fibers, needs current appraisal to determine changing consumer attitudes toward and preference for the various fibers. Laboratories can use the data which suggests the need for product improvement. And finally, the producer benefits when the consumer is most satisfied and uses more of his product. (1955 3/14)

9. Market Potential for Cotton Linters -- Initiate studies to determine the possibilities for improving the competitive position of cotton linters.

This work, in close cooperation with UR, will involve ascertaining the present economic position of cotton linters relative to that of other raw materials in specific end uses; analyzing the factors contributing to the decline in importance of linters for certain applications; determining the quality characteristics desired and required to maintain and improve the market position for linters; and determining from the standpoints of cost and competitive prices and other considerations whether chemical treatments as developed through utilization research offer real and practical possibilities for imparting properties to linters that will lead to an expanded market demand. (New) (See Corresponding Utilization Research proposal, on "Determining Utilization Potential for Linters")

- *10. Determination of Fiber Length and Fiber Length Distribution -- Initiate work to construct a device to sort cotton lint rapidly as to length, using demonstrated photoelectric techniques for the purpose.

The present methods of determination of fiber length distribution are too slow for most routine work in cotton breeding, marketing, and utilization. Some of the methods (single fiber measurements and Suter-Webb sortings) are slow but of great value for research purposes. The proposed method should aim for the accuracy and range of data now found in the research methods, but should speed up the measurements very greatly.

The proposed method should give a greater range of data quicker than the present Fibrograph, the current instrument for routine work. The new photoelectric scanner should be adaptable to manual or mechanical operation and should lend itself for connecting to electronic and computing devices. In preliminary trials it appears that the sample scanned using this new method may be superior to samples used in current methods of fiber length sorting. (New)

- *11. Moisture Determination in Cotton by Non-Destructive Means --
Initiate research to investigate the possibilities of applying nuclear magnetic resonance techniques for non-destructive determination of moisture in cotton.

Recent measurements at several laboratories have shown that nuclear magnetic resonance (radiofrequency spectroscopy) can be applied to the measurement of moisture in fruits, vegetables, and certain cellulosic materials, such as starch. Such a measuring technique, if applicable to cotton, will provide a non-destructive method of measuring the important quality factor of moisture and hence would be of great value not only in research programs on methods of quality maintenance and control but also as a better means of determining the quality grade of fiber. (New)

12. Standard Density Bale Presses at Cotton Gins -- Initiate a study to determine the effects of standard density bale presses at cotton gins on (1) the fixed and operating costs of gins, (2) the volume of ginning necessary for the economical use of such presses, and (3) the economic benefits and problems involved in the various phases of marketing standard density ginned-pressed bales compared with regular flat bales.

A concentration of more than 30 of these standard density presses exists in the San Joaquin Valley of California and as many more are scattered throughout other parts of the Cotton Belt. The proposed study would provide interested ginners, farmers, and others with a better basis for determining the feasibility of making similar installations in other gins throughout the Cotton Belt and their effects on the costs and practices in assembling, handling, storing, transporting, and pricing American cotton. The possibility also exists that these gins, particularly where used in conjunction with the automatic sampler, would contribute to the solution of some of the problems of the condition and appearance of bales often received by domestic mills and for export shipments. (New)

13. Marketing Immature Cotton -- Initiate work to determine the extent, sources, and seasonal distribution of the immature cotton marketed in the United States, the problems associated with the marketing of this cotton, and means of correcting or minimizing these problems.

With the rapidly expanding use of micronaire measurements as a quality factor by merchants and manufacturers and the penalties being imposed on cottons with low micronaire readings, there is growing interest and concern as to (a) the sources, extent and distribution of the so-called fine-fibered U. S. cottons produced, consumed and exported, and (b) the relation of the price differentials to the spinning utility of such cotton. It is contended that more complete and reliable information of this type, available to all groups directly involved in selling, buying, and processing raw cotton would be highly beneficial to all segments of the cotton industry. Such information would help (a) bring about and maintain more equitable price differentials in local, central, and mill markets, and (b) indicate at least something of the nature, location, and extent of any needed adjustments in the production and consumption of such cottons. In view of the increasing competition of man-made fibers, foreign cottons and other products, it is highly important that the marked gains being made in the U. S. in developing and utilizing higher yielding cotton varieties and more efficient production and harvesting practices are not offset or minimized by unfavorable developments with respect to any important cotton quality factors such as fineness or maturity. This proposed study would not only help to avoid this possibility but should aid in bringing about more rapid gains in breeding and producing American cotton with those quality elements which are most desirable. (1955 11/14)

- * 14. Cotton Fiber Property Combinations for Optimum Performance in Each of Several Fabric Properties -- Expand research to establish the cotton fiber property combinations that will produce optimum performance in the finished fabric with respect to strength and other fabric properties.

The current quality relationship investigation on cotton fibers is concerned with the relationship between three fiber properties, namely, fiber fineness, elastic modulus and cross-sectional shape, and the functional behavior of fabrics including strength, abrasion resistance, and drape. The experimental design of this study should indicate not only the influence of the fiber properties on fabric performance but also suggest combinations of fiber properties which might be expected to give optimum performance. This optimum is likely to occur at fiber property combinations outside those included in the present work, hence expansion of the study is required to investigate these new possibilities for obtaining optimum performance. (New)

15. Pricing in Relation to Fiber Properties -- Initiate a study to explore ways and means of more effectively pricing cotton on the basis of such fiber properties as fineness, strength, and maturity, as well as on grade and staple length.

Cotton price quotations as currently reported are given largely in terms of grade and staple length. Such other fiber properties as strength, fineness, and maturity, which are now being used to a considerable extent in the marketing of cotton, are for the most part reflected in the prices generally quoted only insofar as they may represent what the cotton classers consider to be normal character. All important fiber properties contribute to the true values of raw cotton, but their contributions to such values are always in combinations and vary not only with differences in the individual properties and the combination involved but also with the different types and qualities of products made from the cotton. As additional fiber properties are separately measured and recognized as important, the difficulties involved in the pricing of cotton becomes greater. However, before mechanical and chemical means of classification can attain full significance, ways and means must be worked out for more effectively pricing and quoting the prices of cotton on the basis of additional fiber properties, either singly or in combination. (New)

16. Seed Cotton Cleaning Capacity vs. Gin Operating Efficiency and Costs -- Initiate a study to determine and evaluate the effects of increased cleaning capacity, as achieved by dual cleaning systems, on seed cotton cleaning efficiency and operating efficiency of the gin stands.

Recent time meter studies have indicated that many gins are making far less than maximum utilization of their ginning facilities, particularly at plants operating with a recently increased number of conventional size stands (as those utilizing the new 90-saw stands). Apparently one of the major causes for this lowered efficiency is the problem of getting the seed cotton through the cleaning and conditioning equipment in sufficient constant volume to insure full-time operations of the gin stands. The study should be made in the Southwest and Far Western areas where ginning capacities and volumes are large and where important proportions of the crop are either harvested mechanically or by hand-snapping. (1955 13/14)

17. Determining the Gin Weights of Cottonseed -- Expand the work relating to the gin weights of cottonseed to include other major cotton-producing areas where seed scales are not generally used by gins.

The preliminary study now under way is limited to data from 5 gins in 2 areas. Variations were noted in the weight of cottonseed ginned from comparable bales at the same gin, between 2 gins in the same areas, between the same gin in different years, and between the 2 areas studied.

The problem has been recognized by responsible ginners in nearly all areas in recent years, and particularly in areas where increasing proportions of roughly-harvested cotton, with the resulting higher percentage of foreign matter, have increased the difficulty of estimating seed weights. A number of gins have installed improved designs of seed scales on an experimental basis. An analysis of data from some of these gins would provide an accurate measure of errors and variations involved in estimating cottonseed weights from either the seed cotton or the ginned lint. (New)

- * 18. Improved Clamps for Cotton Fiber Tensile Machines -- Initiate research to develop and build an improved clamp for cotton fiber tensile testing machines to provide for more expeditious measurement of stress-strain properties of cotton fiber ribbons.

All segments of the cotton industry have a vital interest in the improvement of cotton fiber testing methods. Although much has been done to refine measurements of cotton fiber strength, the industry still desires faster testing methods and in addition is becoming aware of other aspects of stress-strain properties. For example, the jaws of fiber tensile testing instruments have been quite exhaustively studied; nevertheless further effort is justified (a) to increase speed of closing and opening the jaws, and (b) to develop positive gripping for minimizing uncontrolled fiber within the jaws which would cause error in elongation measurements. It is the purpose of this project to develop a better set of clamps to hold cotton fibers for flat bundle strength tests. (New)

19. Standard Moisture Content as a Basis for Trading in Cotton-- Initiate research to determine the probable effects of a standard moisture clause in American cotton trading rules on the cotton trade and industry; determine what physical

facilities or equipment would be necessary to make a standard moisture clause in trading rules workable; and outline the steps necessary to initiate trading on such a basis.

For many years suggestions have been made that the American cotton crop be marketed on the basis of a standard moisture content. Such suggestions have been more frequent in recent years as American cotton's share of the domestic and foreign textile markets has declined and as more members of the cotton industry become increasingly aware of the fact that manmade fibers and some foreign cottons are sold on a standard moisture content basis. A study of the problems and probable effects of such a method of trading in American cotton would provide the domestic cotton industry with a basis upon which to formulate any changes in trading rules and practices which might be considered desirable. (1955 General Rec.)

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20. Costs of Selected Operations in Manufacturing Combed Cotton Knitting Yarn -- Initiate research to ascertain the influence of various factors on the efficiency of one or more operations, or groups of operations (such as opening and picking, carding and combing, spinning, winding, etc.), involved in the manufacture of combed cotton knitting yarns and means of improvements.

Information available indicates considerable variations from one plant to another in the efficiency of these operations. Such variations and other information suggest the possibility of making substantial improvements in the efficiency of these operations. The importance of making such improvements may be indicated by the fact that gross margins for manufacturers of combed cotton knitting yarns average more than gross returns to farmers for the cotton used and more than 5 times as much as gross margins for ginning and merchandising the cotton. Carding and combing operations alone account for more than 25 percent, and spinning accounts for more than 50 percent of total conversion costs for combed cotton knitting yarns. The selection of the kinds and number of operations to be included in the study and plans for developing the research will be made in cooperation with operators in the industry and others. It is anticipated that the research will be developed, under contract, by a competent agency trained in textile cost engineering and familiar with the combed cotton yarn industry. (New)

21. Power and Fuel Utilization at Gins -- Initiate study of selected gins to determine the kinds and amounts of power and fuel consumed as related to (1) the type, size and amount of cleaning, conditioning, and ginning equipment, and (2) to the rates of ginning.

With the increasing costs of power, fuel, and other factors during recent years and the strong competition cotton is encountering from synthetic fibers, paper, and other products, it is increasingly important to ginners, farmers, and other segments of the industry that the efficiency as well as the quality of the ginning services be maintained and improved wherever possible. Indications are that power and fuel utilization by gins represents an area where economic study could point the way to needs for and means of significant savings in costs of gin operations. Study initially would be made in the Southeast where gins generally are below Beltwide averages in size and volume and therefore often find it especially difficult to keep up with new developments. (1955, 12/14)

22. Practices and Problems in Local Marketing and Direct Mill Buying of Cotton -- Initiate study to determine practices and problems in the marketing of cotton at growers' local markets with a view to developing possibilities for improving the efficiency of local marketing operations and the organization of such markets. Study also is needed relating to nature of sales outlets available to growers and the role played by mill buyers within such markets.

Presently some 2,000 or more sites function as market places for growers. Many of these markets receive very small annual volumes, maintain little or no facilities for handling or storing cotton, and are served by only one buying outlet, a combination frequently contributing to an inefficient and high cost situation also lacking in competitive aspects. Local markets represent the sole contact of most growers with the marketing system and provide the point of entry of cotton into commercial channels. In the Southeast, cotton manufacturers are major buyers of cotton from local dealers, but elsewhere cotton merchants are a principal medium for resale. Proficiency at advanced levels of marketing will not eliminate adverse effects of inefficiencies at the primary stage of marketing thereby centering need for attention to the weak link in the system.
(New)

23. Costs of Selected Operations in Manufacturing Cotton Fabrics -- Initiate research to ascertain the influence of various factors on the efficiency of one or more operations, or groups of operations (such as opening and picking, carding and combing, slashing and drawing, weaving, etc.) involved in the manufacture of specified cotton fabrics (such as selected sheeting, print cloth, denims, etc.) and means of improvement.

Information available indicates considerable variations from one plant to another in the efficiency of these operations. Such variations and reports for the industry suggest possibilities of making substantial improvements in the efficiency of these operations. The importance of making such improvements may be indicated by data which show that gross margins for manufacturers of carded cotton yarn fabrics average more than the cost of the cotton used, and gross margins for manufacturers of combed cotton yarn fabrics average about twice as much as the cost of the cotton used. Costs of weaving operations alone, on the average, are equal to about one-third of the raw cotton costs to the mills for carded yarn fabrics and about two-thirds of cotton costs for combed yarn fabrics. The selection of the fabrics and the kinds and number of operations to be included in the study, and plans for the development of the research, will be made in cooperation with operators in the industry and others. It is anticipated that the research will be developed, under contract, by a competent agency trained in textile cost engineering and familiar with the cotton manufacturing industry. (New)

COTTON AND COTTONSEED PRODUCTS

1. Survey of Homemakers' Use of and Opinions about Margarine and Butter as a Tablespread and for Home Cooking --
Initiate a consumer survey of homemakers' usage of and opinions about margarine and butter, to provide factual information on which to build sound programs of research and sales promotion and to stimulate a stronger consumer demand for margarine, thereby providing a bigger market outlet for domestic vegetable oils. (1955, 1/8)
2. Market Outlets for Proteins from Agricultural and Chemical Sources -- Initiate a study to determine the effect of chemical sources of nitrogen, on the market for proteins from agricultural sources, particularly oilseed meals. Indications are that the use of ammoniated products and urea in ruminant feeds is increasing. Marketing research is needed to assess the extent and economic effects of this development and the competitive position of proteins from agricultural sources and chemical sources of nitrogen. (New)
3. Impact of Government Programs on the Cottonseed and Soybean Industries -- Initiate a study (1) to evaluate the effect of the present and proposed programs of support prices for cottonseed and soybeans on the production and the market outlets for their products and (2) to suggest such improvements in public policy with regard to the handling of these commodities as are indicated by the study.

The project would initially undertake a study of the demand for cottonseed and soybean products. Based on the assumption of stability in demand relationships, it should be possible from a knowledge of these relationships to estimate the effects of the existing price support programs for cottonseed and soybeans upon their prices, consumption of the different products, and costs of the programs. (1955, 2/8)

4. Use of Major Vegetable Oils as Affected by Market Conditions -- Initiate an analysis of marketing factors affecting the use of the major oilseeds and vegetable oils in the preparation of food and feeds as influenced by prices, other specific market conditions and competitive circumstances.

These commodities must be marketed with maximum efficiency if they are to hold their most useful positions in the economy. Marketing practices vary considerably from season to season. Such variations in part reflect changes in market conditions; in part they help determine the conditions for competitive commodities. For example, in

1952-53 a greater proportion of soybean oil than ever before seems to have been bought by margarine makers, and a smaller proportion of cottonseed oil. It is important to know the market conditions and organization and the advances in processing techniques that accompany such substitution and shifts in demand by fabricators of fats and oils products. Improvement in marketing practices in relation to marketing conditions should be of benefit both to the industry and to the producers of oilseeds. (1955, 4/8)

5. Margarine Manufacture and Distribution as Related to Costs -- Initiate margarine marketing studies pertaining to manufacturing and distribution methods and practices as related to costs.

Incomplete data indicate that methods and practices, together with costs, vary greatly through the industry. Recent upward trends in the production and consumption of margarine have tended to level off and there is recognition of certain marketing problems. Apparently the manufacturing cost variations depend greatly on (1) size, type, and location of plant; (2) rate and continuity of operation; (3) operating practices; and (4) integration.

In parallel fashion, distribution costs vary with (1) volume of business; (2) marketing channels; (3) marketing organization and practices of the firm and plant; and (4) geographical, seasonal, and trend variations in demand and competition. Leaders in the cotton and soybean industries have recognized the need for more marketing research in this field. A detailed study of the factors involved is needed to indicate ways and means of reducing the costs and increasing efficiency in the marketing and processing of this important vegetable oil commodity. (1955, 6/8)

6. Risks in Marketing and Processing Cottonseed and Soybeans--
Initiate research to obtain information needed to determine where marketing economies may be effected by improved handling of risks, and how producers' returns may be increased.

The risks involved in the procurement, processing, and carrying forward of cottonseed after ginning and soybeans after harvest for the most part are carried by the processors or passed on to the forward buyers of oil and meal. What marketing practices are feasible; how should specific marketing practices be expected to affect mill management practices, costs of processing, sales to consumers, and returns to growers. This would be a cross-commodity project involving both cottonseed and soybeans.

To the extent that farmer storage of soybeans continues to increase, the grower becomes more concerned with the same questions. The risk distributed among the holding parties is equal to the entire value of the soybeans. Either the beans may deteriorate, be lost or destroyed, or their market value may decrease. Although there is no change that all soybeans will be wholly lost, some will be wholly lost and some will shrink physically or in quality. One special problem with soybeans concerns the question of how multiple-point delivery for soybeans traded on the future market would affect the risks of various sectors of the industry, compared with the present single-point delivery rule.

Cottonseed oil mill operators are under economic compulsion to buy practically their entire season's cottonseed requirements during the short cotton ginning season. Consumption of cottonseed products, however, extends over the entire year. Processors must choose between a long and relatively efficient milling season and a shorter, less-efficient season; between shipment of their products to be held by others and releasing them as needed by further processors; between carrying the market risks for the full span of time from the original marketing of the seed to consumption of the cottonseed products, on the one hand, and carrying them for a part of that time, or not at all.

Unless these risks are reduced to a practical minimum and managed effectively, the cost to many individuals and to society is greater than necessary. Often the marketing risks are large in relation to the financial resources of the handler, processor, or farmer. Reduction in the cost of such risk bearing will lower the cost of soybean or cottonseed products or increase returns to producers. (1955, 5/8)

7. Market Outlets for Fats and Oils in Plasticizers --
Initiate a study to explore the existing and potential market for fats and oils of domestic origin in plasticizers.

Utilization research branches have developed chemical bases for the use of fats in plasticizers products. Marketing research is needed to determine the market development required and to assess the economic effect on the total market for fats and oils and the competitive position of fats and oils and synthetics in the plasticizer market.
(Hew)

IV. MARKETING SERVICE AND EDUCATIONAL WORK

/Order of Listing has no Priority Significance/

Service Work by USDA

- A. Cotton Outlook and Situation Work -- Expand cotton outlook and situation work to (1) compile and analyze data by regions and States of the Cotton Belt; (2) expand data on military usage of fibers; and (3) study shifting pattern of textile exports and imports. (1955 -- 5/14 under Marketing Research--Lint)
- B. Price, Supply and Consumption Analysis for Fats, Oils, and Oilseeds--
Expand current work to permit more detailed attention to certain aspects of price, supply, and consumption analysis for fats, oils and oilseeds.

Fields particularly needing more effort are studies of patterns of margins between the value of oilseeds and their end products; the effect of synthetic materials on the demand for nonfood uses of fats and oils used in various food products for which present data are unavailable or inadequate; and the trend in use of fats and oils in filled milk products. Increased attention would be paid to world trade and foreign developments (the U. S. now is a major exporter of oilseeds, fats and oils) and to differences in the Situation and Outlook by producing regions. More time would be made available to develop ways of presenting the work in a manner which would be most useful to farmers and other groups. (1955 -- 3/8 under Marketing Research)

Service Work by State Departments of Agriculture

- A. Ginning Services - Expand technical assistance to cotton gins in improving the effectiveness and efficiency of ginning, sampling and baling operations and in the use of methods and techniques for measuring fiber qualities such as the use of Micronaire readings for fiber fineness (Same as 1955 Recommendations)
- B. Use of Government Classing Service -- Expand service programs to encourage producers, ginners and buyers to (1) use the Government classing service in determining cotton quality, in order that differences in quality will receive more appropriate consideration in buying and selling, and (2) to attend cotton classing schools and demonstrations to learn how cotton quality and value are determined. (Same as 1955 Recommendations)

Marketing Educational Work of the Cooperative Extension Service

- A. Cotton and Cottonseed Marketing. Expand and further develop educational work by the Cooperative Extension Service on cotton ginning, improving marketing methods and practices, sampling, grading, packaging and labeling, use of instruments in quality measurements, cottonseed grading and marketing, warehousing and compress operations.

- B. Cotton Utilization. Expand and further develop educational work with cotton textile industries on the application and use of research on new uses, improved processing methods, new and improved products, quality evaluation and measurement of raw cotton and industry developments.
- C. Marketing Information for Consumers. Expand and further develop marketing information for consumers on cotton textile products for apparel and household uses as an aid to wise selection and use and the expansion and maintenance of market outlets.



